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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/508,971	11/10/2004	Akihiko Yoshida	L79990.04103	1131

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EXAMINER	
LEWIS, BEN	

ART UNIT	PAPER NUMBER
1745	

DATE MAILED: 02/09/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/508,971	YOSHIDA ET AL.	
	Examiner	Art Unit	
	Ben Lewis	1745	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-8 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-8 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 24 September 2004 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

Detailed Action

1. The Applicant's amendment filed on October 18th, 2005 was received. Claims 1, 7 and 8 were amended.

2. The text of those sections of Title 35, U.S.C. code not included in this action can be found in the prior Office Action (issued on July 18th, 2005).

Claim Rejections - 35 USC § 102/103

3. Claims 1,2 and 3 are rejected under 35 U.S.C. 102(e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Hirahara et al (U.S. Pub. No. 2002/0160252 A1).

With respect claims 1, 2 and 3, Hirahara et al teach that the membrane electrode is constituted basically of a solid polymer electrolyte membrane (ion-exchange membrane) and a catalyst layer, gas diffusion layer, and current collector bonded in this order to each side of the electrolyte membrane (Paragraph 0003). Hirahara et al also teaches that a conductive carbonaceous fiber sheet for solid polymer electrolyte fuel cell wherein two-folded yarns composed of single yarns each obtained by collecting from 45 to 50 polyacrylonitrile-based long oxidized fibers having a monofilament diameter of 8 um with twisting were woven at a warp density and a weft

density of 50 yarns and 46 yarns, respectively, per inch to obtain an oxidized plain weave fabric. This woven fabric was heated to 900 ^{0}C in a nitrogen stream to carbonize it and then heated to 2,000 ^{0}C in an argon atmosphere to conduct graphitization. The graphitized carbonaceous-fiber woven fabric obtained had a warp density of 70 yarns per inch (corresponding to 276 yarns per 10 cm) and a weft density of 54 yarns per inch (corresponding to 213 yarns per 10 cm) (Paragraph 0072). However, it is the position of the examiner that other properties of said material, such as the distance where said warp and weft threads cross each other, the thickness of said fabric, the height of said warp thread and the width of said weft thread are inherent, given that the material of construction of the carbonaceous fabric disclosed by Hirahara et al and the present application have similar dimensions. A reference which is silent about a claimed invention's features is inherently anticipatory if the missing feature is necessarily present in that which is described in the reference. Inherency is not established by probalities or possibilities. In re Robertson, 49 USPQ2d 1949 (1999).

Alternatively, it would have been obvious to one of ordinary skill in the art to adjust the thickness of said fabric, the height of said warp thread and the width of said weft thread of the gas diffusion layer fabric because Hirahara et al teach that the invention provides a conductive carbonaceous-fiber sheet which has a thickness of from 0.05 to 1 mm (Paragraph 0010). A preferred example of the woven fabric is a fabric obtained by weaving two-folded yarns having a metric number of from 20 to 60 composed of single

fibers having a diameter of from 7 to 10 um by plain weaving at a warp density and a weft density of from 30 to 70 yarns per inch each (Paragraph 0040). Therefore, it would have been within the skill of the ordinary artisan to adjust the warp density, weft density and metric number of the weaving process to yield the desirable ratio of X/Y in the gas diffusion layer of Hirahara. *Discovery of optimum value of result effective variable in known process is ordinarily within skill of art.* In re Boesch, CCPA 1980, 617F.2d 272, 205 USPQ215.

Using the fiber dimension values disclosed by Hirahara et al

Diameter of fiber = 10um thickness Y= 0.18mm

70yarns/in

total space between threads/ in = 2.54cm – 0.07cm = 2.47cm

distance between threads = 2.47cm/69 = 0.035cm=X

X/Y = 0.035cm/0.018cm = 1.94 which satisfies the equation 1.4 <= X/Y <= 3.5.

Claim Rejections - 35 USC § 103

4. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hirahara et al (U.S. Pub. No. 2002/0160252 A1) with respect to claims 1,2,3 and 7 above and further in view of Kawahara et al (U.S. Pub. No. 2002/0045089 A1)

With respect to claim 4, Hirahara et al disclose a gas diffusion electrode above. Hirahara et al do not specifically mention the gas diffusion electrode having a water

repellent layer. However Kawahara et al disclose a diffusion layer for a fuel cell wherein the water-repellent layer can include carbon powder (the power may be particles, and the carbon power can be, for example, carbon black) and a binder for binding the carbon powder. The binder can be made from synthetic resin (for example, fluororesin such as polytetrafluoroethylene). Each water-repellent layer 13a, 16a and each base layer 13b, 16b has permeability so that hydrogen and air can reach the catalyst layer 12, 15. A thickness of each water-repellent layer is about 50 um (Paragraph 0075). Therefore it would have been obvious to one of ordinary skill in the art to incorporate the water repellant layer of Kawahara et al into the diffusion layer of Kawahara et al because Hirahara et al teach that the water resistance of the diffusion layer can be improved by providing the yarn with a water-repellent characteristic and that the diffusion layer can be manufactured by treating a conventional carbonized woven fabric (Paragraph 0048).

5. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hirahara et al (U.S. Pub. No. 2002/0160252 A1) with respect to claims 1,2,3 and 7 above and further in view of Menashi et al (U.S. Pub. No. 2003/0022055 A1)

With respect to claim 6, Hirahara et al disclose a gas diffusion electrode above. Hirahara et al do not specifically mention the thickness of the catalyst layer. However, Menashi discloses a gas diffusion electrode wherein the the catalyst layer is very thin such as 10 microns or less thick (Paragraph 0029). Therefore it would have been obvious to one of ordinary skill in the art to incorporate the catalyst layer with thickness

of Menashi et al into the diffusion layer of Hirahara et al because Menashi et al teach that if the catalyst layer cannot be made thin, porosity in the active layer is generally needed to aid transport of the reactive gas to the catalyst (Paragraph 0029).

6. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hirahara et al (U.S. Pub. No. 2002/0160252 A1) with respect to claims 1,2,3 and 7 above and further in view of Grot (U.S. Paten No. 6,641,862 B1)

With respect to claim 5,Hirahara et al disclose a gas diffusion electrode above. Hirahara et al do not specifically mention the thickness of the electrolyte memebrane. However, Grot discloses a method of preparation of fuel cell electrode assemblies wherein, typically, the membrane is between 10 and 200 microns thick, and is prepared from ionomer resin (Col 1 lines 10-22). Therefore it would have been obvious to one of ordinary skill in the art to incorporate the electrolyte membrane with thickness of Grot et al into the diffusion layer of Hirahara et al because Grot teach that the membrane performs a proton transport function in the cell, and provides electronic isolation between anode and cathode, thus providing a means of keeping fuel and oxidant from mixing. Typically, the membrane is between 10 and 200 microns thick, and is prepared from ionomer resin (Col 1 lines 10-22)

7. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hirahara et al (U.S. Pub. No. 2002/0160252 A1) with respect to claims 1,2,3 and 7 above and further in view of Sugawara et al. (U.S. Paten No. 6,818,339 B1)

With respect to claim 7, Hirahara et al disclose a gas diffusion electrode above. Hirahara et al do not specifically mention the clamping pressure of electrodes and each separator plate in contact with each other. However, Sugawara et al. discloses a polymer electrolyte type fuel cell wherein, a cell module was obtained by claming the two end plates with bolts and nuts passing through the stack. The clamping pressure per unit area of the conductive separator plate was 10 kgf/cm2. A clamping rod for clamping the stack was arranged on a side face, which was different from the side face with the gas inlet and outlet. The cell module thus obtained was used as a fuel cell 1 (Example 3) (Col 16 lines 53-65). Therefore it would have been obvious to one of ordinary skill in the art to incorporate the clamping means and pressure of Sugawara et al into the system of Hirahara et al because Sugawara et al teach in case of clamping by using the clamping rod, it is desirable to evenly clamp the single cells in the plane direction (Col 2 lines 27-37).

8. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hirahara et al (U.S. Pub. No. 2002/0160252 A1) with respect to claims 1,2,3 and 7 above and further in view of Mesaru et al (Japanese Patent No. 2001-085019)

With respect to claim 8, Hirahara et al disclose a gas diffusion electrode above. Hirahara et al do not specifically mention the rough surface of the carbon fabric is

smoothed by heating the surface of the gas diffusion layer before disposing the gas diffusion layer on the polymer electrolyte membrane. However, Mesaru et al. disclose a solid polymer fuel cell wherein a hot press is desirably applied to the carbon cloth at 100 to 250^{0}C and 15 to 150 kg/cm^2 to flatten the surface of the carbon cloth (See Abstract). Therefore it would have been obvious to one of ordinary skill in the art to incorporate the flattening of the carbon cloth surface via hot pressing of Mesaru et al into the gas diffusion layer fabrication of Hirahara et al because Mesaru et al teach that the surface is flattened so that damage of the ion exchange membrane is reduced.

Furthermore, Hirahara and Mesaru et al. do not specifically teach using flame radiation , laser radiation or a radiant heater to smooth the surface of the gas diffusion layer but teach a hot press is desirably applied to the carbon cloth at 100 to 250^{0}C and 15 to 150 kg/cm^2 to flatten the surface of the carbon cloth (See Abstract). A hot press, flame radiation, laser radiation and a radiant heater are functionally equivalent carbon fiber fuzz removal means. Therefore, it would have been obvious to one of ordinary skill in the art to substitute a radiant heater for the hot press in the fuel cell system disclosed by Hirahara et al.

Response to Arguments

9. Applicant's arguments filed on October 18th, 2005 have been fully considered but they are not persuasive.

Applicant's principle arguments are

(a) Hirahara fails to disclose the feature recited in claim 1 of a carbon fiber fabric having warp and weft threads woven such that the distance X between adjacent intersections, where the warp and weft threads cross each other, and the thickness Y of the fabric satisfy the equation 1.4 <= X/Y <= 3.5.

(b) The combined teachings of Hirahara and Sugawara do not render obvious the subject matter of claim 7.

(c) Applicants submit that the applied references, considered alone or together, do not teach or suggest the subject matter defined by claim 8.

In response to Applicant's arguments, please consider the following comments.

(a) Properties of the gas diffusion fabric material, such as the distance where said warp and weft threads cross each other, the thickness of said fabric, the height of said warp thread and the width of said weft thread are inherent, given that the material of construction of the carbonaceous fabric disclosed by Hirahara et al and the present application have similar dimensions. Furthermore, it would have been obvious to one of ordinary skill in the art to adjust the thickness of said fabric, the height of said warp thread and the width of said weft thread of the gas diffusion layer fabric because Hirahara et al teach that the invention provides a conductive carbonaceous-fiber sheet which has a thickness of from 0.05 to 1 mm (Paragraph 0010). A preferred example of the woven fabric is a fabric obtained by weaving two-folded yarns having a metric number of from 20 to 60 composed of single fibers having a diameter of from 7 to 10 um by plain weaving at a warp density and a weft density of from 30 to 70 yarns per inch each (Paragraph 0040). Therefore, it would have been within the skill of the ordinary artisan to adjust the warp density, weft density and metric number of the weaving process to yield the desirable ratio of X/Y in the gas diffusion layer of Hirahara. *Discovery of optimum value of result effective variable in known process is ordinarily within skill of art.* In re Boesch, CCPA 1980, 617F.2d 272, 205 USPQ215.

Using the fiber dimension values disclosed by Hirahara et al

Diameter of fiber = 10um thickness Y= 0.18mm

70yarns/in

total space between threads/ in = 2.54cm – 0.07cm = 2.47cm

distance between threads = 2.47cm/69 = 0.035cm=X

X/Y = 0.035cm/0.018cm = 1.94 which satisfies the equation 1.4 <= X/Y <= 3.5.

(b) Hirahara et al disclose a gas diffusion electrode above. Hirahara et al do not specifically mention the clamping pressure of electrodes and each separator plate in contact with each other. However, Sugawara et al. discloses a polymer electrolyte type fuel cell wherein, a cell module was obtained by claming the two end plates with bolts and nuts passing through the stack. The clamping pressure per unit area of the conductive separator plate was 10 kgf/cm2. A clamping rod for clamping the stack was arranged on a side face, which was different from the side face with the gas inlet and outlet. The cell module thus obtained was used as a fuel cell 1 (Example 3) (Col 16 lines 53-65). Therefore it would have been obvious to one of ordinary skill in the art to incorporate the clamping means and pressure of Sugawara et al into the system of Hirahara et al because Sugawara et al teach in case of clamping by using the clamping rod, it is desirable to evenly clamp the single cells in the plane direction (Col 2 lines 27-37)

(c) The instant specification teaches that, since carbon cloth is a fabric, it has concave and convex portions in the thickness direction on the surface thereof, *which are* unavoidable. In a polymer electrolyte fuel cell intended to be thin in order to achieve

higher performance, the carbon fibers of carbon cloth pierce the polymer electrolyte membrane to generate a micro short-circuit, thereby causing the lowering of voltage (Paragraph 0011). Preferred heating techniques include: flame radiation by, for example, a burner or the like; laser-radiation a radiant heater; etc. By previously carrying out the smoothing treatment of the surface of the gas diffusion layer, it is possible to oxidize the fuzz of carbon fiber and the random asperities to remove them without damaging the fiber skeleton of the carbon fiber, thus preventing the above-described micro short-circuit (Paragraph 0028).

Hirahara and Mesaru et al. do not specifically teach using flame radiation , laser radiation or a radiant heater to smooth the surface of the gas diffusion layer but teach a hot press is desirably applied to the carbon cloth at 100 to 250^{0}C and 15 to 150 kg/cm^2 to flatten the surface of the carbon cloth (See Abstract). A hot press, flame radiation, laser radiation and a radiant heater are functionally equivalent carbon fiber fuzz removal means. Therefore, it would have been obvious to one of ordinary skill in the art to substitute a radiant heater for the hot press in the fuel cell system disclosed by Hirahara et al. because Mesaru et al teach that the surface is flattened so that damage of the ion exchange membrane is reduced.

Conclusion

10. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP

§ 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ben Lewis whose telephone number is 571-272-6481. The examiner can normally be reached on 8:30am - 5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on 571-272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

PATRICK JOSEPH RYAN
SUPERVISORY PATENT EXAMINER

Ben Lewis

Patent Examiner
Art Unit 1745